

SCIENCE

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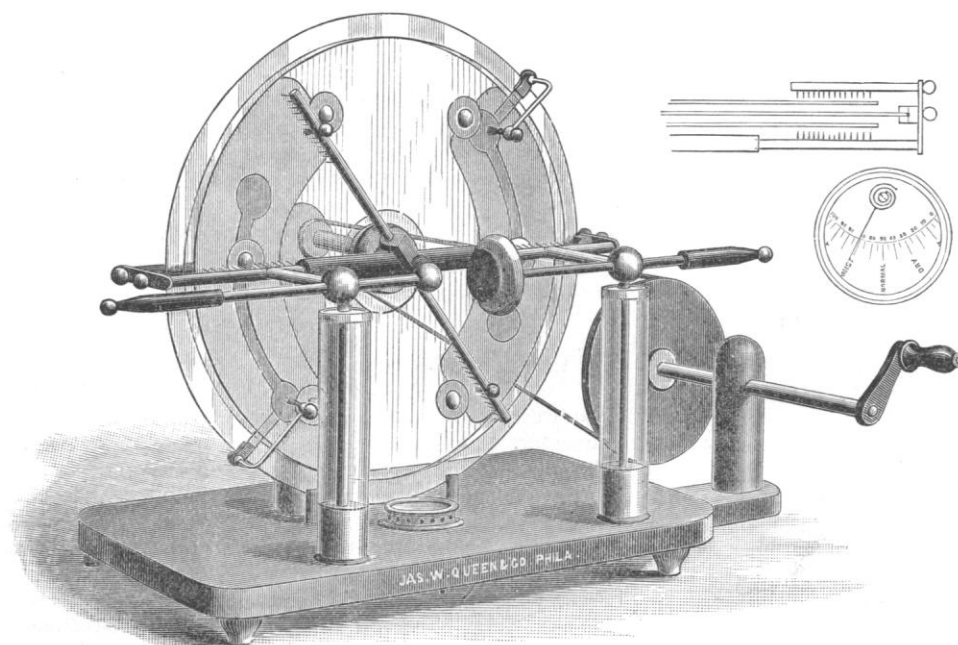
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QUEEN'S NEW TRIPLE-PLATE TOEPLER-HOLTZ MACHINE.

ON this page we print a cut showing some of the details of the new Toepler-Holtz machine, which has just been patented by James W. Queen & Co., the well-known manufacturers of philosophical apparatus and electrical test instruments. This machine, unlike very many that have appeared from time to time, is not simply a modification of the orthodox model, embodying certain conveniences, but is an entirely new thing, owing its efficiency to entirely novel ideas of construction and action.

This machine, as its name indicates, is a three-plate machine; it is not, however, the same thing as the machine usually spoken

effects, of possibly even greater importance than those just mentioned. The advantage of this new form of machine becomes especially marked during moist weather. At such times ordinary frictional machines will not work at all; and all older text-books direct that electrical experiments must be performed during January and February, when the weather is clear and dry. With the Toepler-Holtz machine, as now known, this requirement has not been so rigid, although such machines are not to be always trusted during damp seasons, as lecturers have found out to their sorrow. This difficulty it has been desired to do away with in this new form, and that it does it very effectually will be evident from the following letter sent to Queen & Co. by Professor William A. Anthony, the well-known electrician, and late professor of physics at



NEW TRIPLE-PLATE TOEPLER-HOLTZ MACHINE.

of as the "double revolving plate machine," although it does have two revolving plates. The latter machine is simply an ordinary Toepler-Holtz machine doubled; i.e., with a revolving plate behind the fixed plate, exactly like the one in front, and acting in exactly the same manner. In this new form, the additional plate is not like the front revolving plate, nor does it act in at all the same way. The third and additional plate is here a perfectly plain glass plate, mounted upon the same axis as the usual revolving plate, and placed behind the fixed plate. Its *modus operandi* is, like many other points in the theory of the Holtz machines, not entirely understood, although there is no doubt but that much of the increased efficiency obtained by its use is due to the screening effects it has upon the other plates; i.e., to the leakage that is prevented by its presence. There is also supposed to be a considerable generation of electricity by friction of the plain plate and the air. Undoubtedly many other causes also tend to increased

Cornell University. Says he, "Below is a report of the small Holtz machines you sent up a few days ago. First, in order to determine whether the extra plate gave any increased effect to the machine, I set up both machines, and arranged them so that they both could be revolved by means of one crank, and so that they would both run at the same speed, and then adjusted the terminals until the sparks occurred with about the same frequency in both. Then I removed the combs from one of them, so that the third plate would have no effect in the development of electricity, and found that the frequency of sparks on that machine was very much less than on the other. I repeated this several times, with the same result, and tried the same experiment on the other machine; that is, leaving the combs on the first machine, I removed them from the second, when that one was found to give considerably less electricity than the first. I can say unhesitatingly, therefore, that the addition of the third plate does

very much increase the rate of discharge, and, as nearly as I could tell by this rough experiment, about double the rate.

"In regard to the general action of the machine, I can say that I have never seen any machines of the Holtz or Toepler-Holtz pattern that worked so uniformly well in all weathers. One of these machines has been standing on the table here in the office for several days, and I have tried it almost every day, and have never had it fail to generate. During some of the time it has been here, the weather has been very damp and rainy, — sometimes so damp that I did not expect the machine to work at all, — but I have never found it fail to build up quickly, and give a spark two inches long. [This was one of the smallest-sized machines.] This shows that you have succeeded in finding some very good glass, and also that the insulation of the various parts is of the very best. The addition of the round disk, with the insulator in front of it, as one of the electrodes, is also a very interesting one, as it permits of one of the best experiments that I have ever seen for showing the difference in the discharge when the polarity is reversed. The difference in the character of the discharge from the knob is very marked when the knob changes from positive to negative. I may say, therefore, that I consider all the special features of the machine as distinct and important improvements."

Another great improvement that is made in this machine is the form of the electrode which is used. This is made of a metallic disk two inches or more in diameter, and hollow, so as to have very gradually rounded edges, thus preventing any leakage at the edges. Over this disk, separated from it by about an eighth of an inch, and nearer the other electrode, is fastened a thin disk of vulcanized rubber about half an inch less in diameter. This rubber disk plays the part of the rubber sheet sometimes held between the electrodes, and compels a much higher potential to be established between the two electrodes before a spark can pass. It can be used upon either one or both electrodes, as desired.

These new machines are being sold by Messrs. Queen & Co. at the same price as the ordinary form heretofore used, and are gotten up in the finest possible manner. It may be mentioned, also, that the plates used in Messrs. Queen & Co.'s machines are manufactured and prepared by Voss himself, the inventor of what is usually known as the Toepler Holtz machine, and are guaranteed to give much finer and more reliable results than any plates made in the American market. There are certain little tricks of the manufacture and application of the insulating shellac which Americans have not yet mastered, pursued by the Germans to perfection, and which add greatly to the efficiency of the machine.

It may not be generally known that Messrs. Queen & Co. were the first to introduce the Toepler-Holtz machine into this country.

In 1880 the manager of their physical department, Joseph J. Walton, while on a business trip abroad, accidentally learned of the existence of this machine, examined it, and was so favorably impressed by it that he purchased a number for introduction into this country. This was the first appearance of the now well-known Toepler-Holtz machine in the United States. It was exhibited soon afterwards by the before-mentioned gentleman at the meeting of the American Association for the Advancement of Science, and attracted much attention. It immediately became popular, and had such a large sale that it was straightway copied by various American makers, and patents secured upon modified forms.

WYNNE'S ELECTRIC TRAMWAY SYSTEM.

THE system of electric tramways invented by Mr. Frank Wynne of 5 Westminster Chambers, London, aims at connecting a moving tramcar with an electric conductor buried beneath the roadway, without the use of an open slot. To effect this there is laid in the centre of the track a crenellated contact-plate or rail, in short sections, of the form shown in the annexed engraving. It is half an inch wide on the surface, and about four inches and a half deep, the form being such as to follow the junction line of the sets. It will be seen that the contact-plate will be quite different in its effect upon vehicles from the tramway rail; wheels will cross it without difficulty at

any angle, since they cannot slide along it for more than a few inches; horses will also find a good foothold upon it. The plate is laid in short sections entirely disconnected from each other, and each piece is coupled by a wire to the electric conductor beneath. In this wire is an automatic switch which makes circuit between the section and the conductor as the car comes over it, and breaks the connection when the car has passed. Only three sections are ever connected to the conductor at a time, and generally there are only two. A strong wire brush on the car rubs along the sections, and conveys the current from them to the electric motor, whence it flows to the rails and to earth. The automatic switch is exceedingly simple: it consists merely of an electro-magnet, an armature, and two contact-pieces. Supposing the car-brush is in contact with No. 1 section, the current will flow from the main conductor across one contact to the armature, through the armature to a second contact, thence through the magnet-coils to the section and the motor. A fine wire connects the armature



to the magnet of the next section, but, as no current flows through it, the armature of that magnet is not attracted. But immediately the car-brush touches that section, the current flows, the armature is attracted, and the section is connected directly to the main conductor. At the same time, the armature of the section over which the car has just passed drops, and breaks the circuit. Thus, as the car proceeds, it successively takes sections into circuit and drops them out. The details of the system have been very carefully worked out with the view of meeting every contingency that may arise in working, and it is estimated that the system can be applied to an existing tramway for an expenditure of \$11,000 per mile of single line; that is, for about the cost of horses and horse-cars. *Engineering* says, "This seems one of the most promising schemes for electric tramways which has been yet brought out in this country [England], and it is well worth a trial. The astonishing success of electric trams in America will be repeated here as soon as a system has been developed suited to English tastes and ideas."

WATER-SPOUTS.¹

HAVING sailed from New York the 16th of October in the United States steamship "Pensacola," we had first a few days of westerly winds and moderate sea, and then fell upon a region of easterly winds, generally south-easterly, and with every indication that we were in the easterly portion of a cyclonic region, the storm-centre being three hundred to five hundred miles to the westward. From such observations as we were able to make on shipboard, it was concluded that the storm-centre, which on the 20th of October was south-westerly, was slowly moving to the north-eastward, and would overtake us and pass beyond. This it apparently did, and disappeared from our observation on Friday the 25th. Meanwhile we experienced warm south-easterly winds, with numerous showers of rain and occasional squalls of wind.

On the morning of Tuesday the 22d we were favored with a remarkably fine development of water-spouts. About 9 A.M., occasional whirls of spray were seen on the surface of the sea, at points bearing between south-south-west and west-south-west. These whirls, and the subsequent water-spouts in that region, were all on the north-easterly side of a region of cloud and rain, the interior of which constituted a veritable rain-squall. The north-easterly side of this region, as seen from the vessel looking south-westward, was bordered by rolls of low scud upon which the sun shone; but beyond and below this the clouds, being mostly in the shade, had the dark-blue tint that belongs to the rain-cloud and the rain. The water-spouts apparently originated in the scud-clouds, which, as I have just said, formed the north-easterly border of the squall proper. These scud-clouds were

¹ From Bulletin No. 6, by Cleveland Abbe (Nov. 7, 1889), of the United States Scientific Expedition to West Africa, 1889 (David P. Todd, director).

moving towards the north-west, and therefore nearly perpendicularly to our line of sight. By 10 A.M. the conditions for the formation of the water-spouts, namely, the long axis extending down from the clouds, had become very favorable; so that from 9.30 until 10.15 there was a continued succession of such spouts, forming and disappearing in this portion of the horizon. At one time as many as five and seven were visible simultaneously; and the total number that formed and disappeared was estimated at about thirty by some, but at about twenty by myself. The first ones formed were at a distance from us estimated at about four miles; the last ones, at a distance of two or three miles. As the squall grew in dimensions and approached us, it was hoped that spouts would be formed much nearer; and in fact one was observed endeavoring to form in a mass of rain, at a distance of scarcely a quarter of a mile on our starboard bow. A number of drawings of these phenomena were made, and some photographs were taken. The latter, however, are not considered very successful, owing to the insufficient contrast. Among the features noted in these water-spouts, which will, I think, deserve to be ranked as general phenomena for all such spouts, are the following:—

1. The whirling motion of all the spouts took place in the same direction, so far as could be judged, and was that ordinarily called "counter clock-wise."
2. The general motion of the water-spouts as a whole was from left to right, or from the south-east toward the north-west, and therefore counter clock-wise, considered as a partial rotation round the centre of the rain-squall.
3. As this rain-squall was essentially a part of the formation of a cumulus-cloud out of a mass of what would otherwise have been called low scud, and as no water-spouts, or any tendency to the formation of such, were seen on the other side of the cloud after it had overtaken us, as it did at 10.30, I conclude that the formation of the water-spout requires a special upward ascending current due to a special buoyancy in one portion of the cloud; and, other circumstances being the same, such buoyancy must generally be found, as in this case, on the sunny side of the cloud, and is due largely to the action of the sun's heat on the surface of the cloud, combined of course with the buoyancy of the ascending cloud masses. As regards the individual tornadoes or water-spouts, it is very evident that a less rapid whirl was required to form the little saucer-shaped mass of spray at the ocean's surface than was required to form the axial cloud that reached down from above. There were, I think, more cases in which the spray appeared first, before the cloudy axis was visible, than the reverse cases; but there was nothing to show that the ascending movement started at the ocean's surface, and carried the sea-water upward into the cloud. On the contrary, all the details of the phenomena showed that the spray carried up from the surface of the sea attained only a height of perhaps a hundred feet, and was then thrown out, and descended from the rim of the saucer. In some cases the axial cloud apparently descended into, and was lost sight of in, the lower spray, but its appearance was such that it was always possible to distinguish it from the spray. The axial cloud invariably began its formation at the lower surface of the general cloud, and stretched downward by spasmodic efforts, gradually increasing its length until it perhaps reached the spray, and then began retreating, forming and re-forming several times, until finally either a permanently steady, tubular cloud was formed, which would continue in sight, bending and swirling; or for several minutes, or, as in many cases, after several efforts the whirl broke up, and no permanent tube was formed. When the cloud was about to shoot down to a considerably lower level than it had hitherto attained, the shooting was generally preceded by the appearance of an exceedingly fine axial line; and when the tubular cloud shot down, as seen by the distant observer, I should say that this apparent descent was merely the sudden expansion to a visible diameter of the fine line that had just preceded it. The appearance of this fine line was very similar to that of the sting of a bee protruding from its sheath; and frequently I saw this line shoot down and disappear a number of times before the rapid whirl was finally able to produce an axial cloud of permanent size. In many cases

the axial cloud itself showed a fine line down its centre, the cloud itself being whitish; while the central line was either dark or bright, depending upon the background against which it was seen. This agrees perfectly with the accepted theory of the formation of the spouts, according to which the long narrow cloud is not a solid mass of cloudy material, but rather a hollow cylinder; so that when one looks through it the central portion is much more transparent than the edges.

At numerous points, from the general cloud under which the water-spouts were formed, there were descending showers of rain; and scud, from which rain descended, afterwards formed between us and the tornadoes, and finally again off the port side of the vessel; so that by 10.20 we were enveloped in a heavy rain, with the wind from the south-east or starboard side. This continued ten or fifteen minutes, after which it slackened up. In hopes that we might get near enough to the whirl that surrounds the spout, and experience an appreciable depression of the barometer, I carried an aneroid in my hand; but in no case was I able to see that it was affected by any or all of the spouts. The barometer at 9 A.M. had read 30.12; at 9.35 it read 30.08; at 10.20, after the rain-squall had struck us, the pressure rose to 30.20, and at 1 P.M. had sunk again to 30.18. These fluctuations are those that attend ordinary rain-squalls, and have, I suppose, no connection with the water-spouts as such. It was not to be expected that the barometer would fall except within the whirling wind, and possibly within a hundred feet of the axes of the water-spouts.

It has frequently been supposed that the discharge of a cannon will break up a water-spout. On the present occasion, it so happened that a six-pounder was ordered to be discharged in order to clean it out; and this took place in the midst of the display of water-spouts, which were then three or four miles distant. The discharge of the cannon was followed within a few seconds by the breaking-up of one of the spouts; but others remained, and several others were formed a few minutes afterwards, so that the breaking-up of the one can only be considered an accidental coincidence; nor is there to my mind any conceivable reason why the discharge of a cannon, at a long distance from a spout, or even the firing of a cannon-ball through the spout, should be considered likely to have any appreciable influence on the great mass of revolving air.

The general discussion of the mechanism of a water-spout has been so well given by Ferrel in his newest work, "A Popular Treatise on the Winds" (New York, 1889), that I need only say that every thing observed by us on the 22d of October fully confirmed the views therein set forth by him.

On the next day, the 23d, about 8.30 A.M., the clouds looked favorable for a repetition of the water-spout phenomena, and beautiful mammiform clouds were indeed seen developing into the axial clouds of water-spouts. One of these lasted over twenty minutes, but did not reach any considerable distance down toward the sea; nor was any whirl of ocean spray to be seen beneath it.

Of all the spouts seen on the 22d, the largest appeared to have a horizontal diameter of about one-tenth its vertical height. This one also lasted the longest, and, after breaking up, was apparently followed by rain to a greater extent than in the other spouts. The narrowest of these spouts had an apparent diameter of about one hundredth part of its height. The general height of the tops of the spouts was pretty uniform, like that of the scud to which they belonged, and was, I should estimate, about twelve hundred feet.

AMENDED ORTHOGRAPHY.¹

THE alphabetic representation of language has long occupied much of my attention, although my efforts hitherto have been directed to means of facilitating the use of orthography as it is, and not to the advocacy of any changes in spelling. The funda-

¹ From a letter addressed to the House Committee on Printing and to members of Congress and of the Senate, by Alexander Melville Bell, on the scheme of amended orthography recommended by the commission of the Legislature of Pennsylvania.

mental principle of alphabetic writing — namely, a separate letter for every sound, and a single sound for every letter — has been so widely departed from in English orthography that spelling-reformers have not dared to advocate the application of the principle in its perfect and beautiful simplicity, but have contented themselves with attempts to remove the most obvious anomalies in practice.

I should prefer to add at once the necessary radical improvement of new letters for unrepresented sounds; but comparatively few persons seem yet prepared to carry reform to this extent, and therefore the application of a completely phonetic orthography must at present be confined to the initiation of children and of foreign learners of our language. A simplification of general spelling is, however, very desirable, and it is easily practicable by the means recommended by the commission of the Pennsylvania Legislature; namely, by adoption, in the public printing of the United States, of the Joint Rules for Amended Spelling, which have been approved by the Philological Society of London and the American Philological Association.

With your permission, I shall state briefly some of the chief recommendations of the simplified spelling proposed in these rules.

First, Economy of time. About one-half of the time now spent in learning to read will be saved by simplified spelling. Phonetic initiatory systems have been largely tested during a number of years, and the result has uniformly been a saving of not less than fifty per cent in the time required to make good readers.

Second, Economy in printing. In the report of the Pennsylvania commission, made in April, 1889, the saving in expenditure for paper and printing, from the use of simplified spelling, is calculated at seventeen per cent. I have tested this computation by comparing the number of letters in some pages of 'World-English' and of ordinary typography; and I find a difference in favor of the phonetic letters of one in seven, or a little over fourteen per cent in the number of types. Adding the values of labor and paper, this calculation will amount to very nearly the same as that in the report. This economy cannot be considered unimportant, when we reflect that we now waste nearly one column in six in our newspapers, one page in six in our magazines, and one volume in six in all our works of literature. In hand-writing and type-writing, also, for every six letters that we really require, we have the trouble of writing at least seven.

Third, Rationality in teaching. The want of correspondence between letters and sounds stultifies children, and hinders the development of the reasoning faculty in education. We might as well allow a fluctuating value to the numerals 1, 2, 3, etc., as to the alphabetic letters. If *e+a* may sometimes sound *ē* (read), sometimes *ā* (great), sometimes *ē* (head), and sometimes *ah* (heart), why may not 1+2 be sometimes equal to 1, sometimes to 2, sometimes to 3, and other times to 6? The mental confusion in the learner would not be greater in the one case than in the other; and the latter case is not merely supposititious, but, unfortunately, real and existent. In phonetic spelling the learner pleasantly recognizes the truth of relationship between letters and sounds, whereas in common orthography he is painfully aware of the falseness of the pretended relation. He is thus taught a life-lasting lesson of truth or of falsehood in the very beginning of education.

Fourth, Simplicity and practicability. The scheme proposed has the sufficient recommendation of approval by the English and American Philological Societies. As an instalment of spelling-reform, it is entirely unobjectionable, and it will undoubtedly effect a large part of the advantages of a more phonetic system. Every change consists in reduction of the number of letters used in spelling: consequently the plan is altogether a simplification of the method of representation. We who can use the old cumbrous orthography have nothing to learn in connection with the new scheme: we have only to dispense with superfluities.

Fifth, Ultimate perfectibility. A scientific scheme would

necessarily include new letters for unrepresented sounds. The introduction of these is not contemplated in the present movement, but is left to the action of those who will, under phonetic training, be more and more free from existing 'orthographic' prejudices. The scheme indorsed by the philological societies will facilitate the removal, in time, of all remaining anomalies; while it will not create difficulties to stand in the way of future improvements. What we do now within the prescribed limits, will not require to be undone at any time hereafter.

Sixth, Justice to the young. Children are condemned to a positive wrong when they are unnecessarily subjected to a long and severe task in order simply to acquire the use of the instrument of learning. The helplessness of the victims of this wrong should be one chief recommendation of such a measure of redress as that which is now proposed. The time saved in learning to read will be so much added to that for acquisition of knowledge. Teachers and learners will be alike benefited and elevated by the elimination of so much of mere drudgery, and the addition of so much valuable opportunity for profitable study. Brighter and more intelligent pupils will rise to higher standards in the common schools, and every department of education will participate in the advantages begun with learners of the A B C.

Such considerations as are here briefly presented should not require the addition of a single word to induce all but those predetermined against any change to favor the adoption in the public printing of the nation of the proposed scheme of amended orthography.

A short time would suffice to test the influence of this example on general practice. The conductors of the periodical press will not be slow to adopt the changes if these shall be widely approved by the public. At the same time, adoption or rejection will be equally voluntary. The old orthography will remain as legible as it is now; and the vast capital invested in permanent literature will lose none of its present value.

I have spoken of this plan of amended spelling as only an instalment of what is due to our language. To attempt more as a beginning, might be impolitic; to do less would be worthless.

The substance of the rules embraced in the recommendation before you might be expressed in a single sentence; namely, omit all silent and phonetically dispensable letters. This principle would cover every change included in the twenty-four rules.

I cannot refrain from adding that observance of these rules ought to have prevented such a manifest inconsistency as is exhibited by the Spelling-Reform League in dropping *u* from the combination *ou* in *favour*, *harbour*, *valour*; and dropping *o* from the same combination, with the very same sound, in *nourish*, *journey*, *double*. Every change should be a step in a strictly phonetic direction, or it had better not be made. The rule in the 'Report of the Pennsylvania Commission' (p. 36, No. 7) is phonetically right: the League's concomitant to it (p. 37, No. 1) is phonetically wrong. The limits prescribed by the rules must be observed with exactness, or the latter can no longer be called the rules indorsed by the philological societies. This action of the Spelling-Reform League seems to show the same principle at work which has frustrated all previous attempts at amended orthography; namely, prejudice in favor of what is already in use. In a question between the right and the wrong use of letters, such a consideration should have no place.

This is not a subject respecting which enthusiastic advocacy or passionate discussion can be roused. Those who are called to act will be themselves unaffected by the result, for we have passed the stage when the right use of letters was a trouble to us. May we never reach the stage when the difficulties of beginners shall cease to excite our sympathy and inspire our efforts!

The one impediment to the changes which we seek to accomplish — and which reason, right feeling, and policy demand — is simply that of prejudice. We are accustomed to the pres-

ent aspect of words: they serve our purpose very well as they are, and we are inclined to deprecate any alteration, lest it might give a foreign or a mutilated look to what is now familiar and symmetrical to our eye. We should not think of ourselves at all in this matter, but think only of the helpless juvenile throng who crowd into the places which we vacated years and years ago. Simplify spelling for the sake of the little ones who must suffer from our neglect.

One other point calls for notice; namely, the moderate character of the present proposal. The full amount of change that can result from this measure of simplified spelling is but a small part of what is necessary to make the writing of our language phonetic. We shall still have to use double letters for single sounds in a large proportion of both vowels and consonants, and to tolerate many irregularities in such compounds. In fact, the utility of a purely phonetic initiatory method, such as that of "World-English," will be still almost as marked as it is now.

Why, then, advocate this measure? Because it is a step in the right direction, and step by step is the best mode of making progress. There is more to be done than can be effected by one impulse, and improvements once commenced will be carried farther and farther by succeeding generations. Our language is apparently destined to spread over the world. It is worthy of the most perfect vehicle of communication that skill can devise. If we cannot complete the work, we can at least help it on, and leave it one stage more advanced than we found it.

Something must be done. Our spelling is a disgrace. Responsibility for its lawless condition attaches nowhere in particular, but rests everywhere. The burden of this responsibility should be laid on some accountable official empowered to consider and inaugurate improvements. In the absence of any such delegated authority, the direct action of the representatives of the people is invoked, not to impose changes on the unwilling or the indifferent, but only to exemplify, and by example to invite adoption of the method of improvement recommended by competent advisers.

Private efforts have already been most liberally devoted to the work of amending orthography; but no private efforts can be made on the scale, or with the influence, of a measure emanating from Congress. Besides, this work is peculiarly of public and not of private benefit. It must be done by you, or else it must remain unaccomplished.

HEALTH MATTERS.

The Bacteriology of Whooping-Cough.

At the third general meeting of Russian medical men at St. Petersburg, Professor Afanasieff read an able and exhaustive bacteriological essay on the subject of pertussis. At the suggestion of Professor Afanasieff, who was anxious to verify his results, Dr. Semtchenko took up the line to further investigate the matter, especially in clinical regards. The conclusions arrived at by the Kazan pædiatrist, says the *London Medical Recorder*, may be given thus: 1. Afanasieff's bacterium is actually specific, and hence fully entitled to bear the name of the *bacillus tussis convulsivæ*; 2. The micro-organism makes its appearance in the sputum during the catarrhal stage, somewhere about the fourth day of the disease, but possibly still earlier; 3. Subsequently its numerical strength increases, the intensity of paroxysms keeping pace with the increase; 4. The microbes disappear from the discharge, apparently somewhat before a complete cessation of whoops (about the time when the number of paroxysms sinks down to four or two per day); 5. As soon as pertussis becomes complicated with catarrhal pneumonia, the bacilli in the patient's sputa show an enormous increase in number; 6. Altogether, the pertussis pneumonia seems to be quite different from other varieties of pulmonary inflammation; 7. The *bacillus tussis convulsivæ* presents a great importance not only in etiological and diagnostic, but also in prognostic regards; 8. As to the behavior of the microbe toward antiseptic agents, its vitality is destroyed as soon as

the medium (jelly) contains corrosive sublimate in the proportion of 1 to 60,000, or resorcin in that of 1 to 1,200, or phenol in the same one, or hydrochlorate of quinine in that of 1 to 800. Drs. Afanasieff's and Semtchenko's researches were repeated (at least partially) by Professor Tschamer (*Wiener med. Wochens.*, No. 17, 1888) and Dr. E. C. Wendt of New York (*Medical News*, June 2, 1888). On the whole, both of the authors confirmed the statements made by the Russian observers. Dr. Wendt, however, differs from Dr. Semtchenko in some more or less subordinate points. Thus, he could not detect the presence of the bacilli in earlier stages of the affection; neither was he able to notice any co-relation between the number of paroxysms and that of the bacteria in the patient's sputa; while, on the other hand, he found still the bacilli in the discharge, even after a complete disappearance of whoops. In conclusion, Professor Afanasieff draws attention to the several points which demand further elaborate investigations. It is necessary, he says, (1) to more closely examine the distribution of the microbes in the respiratory mucous membrane, as well as in broncho-pneumonic foci; (2) to study the behavior of the bacterium toward various coloring-matters (in order to discover a characteristic differential test for the bacillus); (3) to study the spore-formation (which is important, especially in prophylactic regards); (4) to most carefully inquire into a clinical bacteriology of the pertussis sputa from the beginning to the end of the attack, and even during convalescence (which is important for diagnostic, prognostic, and prophylactic purposes); and (5) to further study the behavior of the bacillus toward all possible parasiticide agents (to possibly discover some specific bactericidal substances, which discovery would prove of untold value in regard to the therapeutics of the infantile scourge in question).

[Sea-Water and the Nutrition of Marine Animals.

Drs. Pouchet and Chabry have recently conducted some experiments of great biological interest. They have reared larval germs of sea-urchins in artificial sea-water and in sea-water deprived of all or more or less of its lime, in order to observe the influence of the composition of the water on the development of the larvæ. Normally a distinct skeleton should develop. According to the *British Medical Journal*, it was found, that, when the larvæ were reared in sea-water deprived of about nine-tenths of its lime, not even a rudimentary skeleton was developed. A very trifling diminution in the normal amount of lime, effected by careful precipitation by chemical re-agents, was found sufficient to interfere markedly with the growth of the skeleton in the larvæ: hence the medium in which some marine germs of life exist would appear to act as a nutritive agent as well as an atmosphere whence oxygen may be obtained for respiration. The influence of the chemical composition of the water in different seas probably determines many differences in the anatomy of marine animals, but Drs. Pouchet and Chabry admit that this question requires much consideration. How far the embryo in the higher terrestrial forms of life may receive nutrition direct from substances in solution in the *liquor amnii*, as well as through the placental circulation, is another question worth solving.

NOTES AND NEWS.

PROFESSOR C. S. PLUMB of Knoxville, Tenn., has accepted the position of vice-director of the Agricultural Experiment Station of Purdue University, Lafayette, Ind., and after the 1st of April next his address will be at the latter place.

— At a recent meeting of the Paris Geographical Society, as we learn from *Nature*, an interesting lecture was delivered by Dr. Hamy on the history of scientific missions in France under the old monarchy. He commenced practically with the reign of Francis I., and described many missions abroad, with purely scientific aims, which are now either forgotten, or the results of which have never been published. Thus, the apothecary to Henri IV. went all over the globe in search of the peculiar products of each country, especially medicinal and food plants; still earlier,

another explorer went to Brazil to study dyeing woods; and, in the last century, Condamine, Dombey, Bougainville, and La Pérouse went on their well-known expeditions. The president, Comte de Bisemont, mentioned that there were still in the archives of the Ministry of Marine copies of the instructions given to travellers and navigators in past centuries, and that these were "positively models of their kind, which could not be followed too closely now." Professor Bureau, of the Museum of Natural History in Paris, observed that a botanical collection made by Paul Lucas in the reign of Louis XIV. still existed in the museum; and he referred especially to Tournefort, of the same period, whom he described as the scientific traveller of former times who perhaps most nearly approached moderns in his methods of observation. He was sent by the king on a botanical expedition to the Levant, with very precise instructions, among others, to collect and observe the plants mentioned by the ancients. He did not confine himself to this, but formed a complete herbarium, which is still preserved at the museum, and is one of its treasures. He was accompanied by an artist named Aubriet, who brought back a large collection of colored sketches, which forms an important part of the unrivalled collection in the library of the museum.

— The fifteenth session of the Sauveur College of Languages will be held at the University of Vermont, Burlington, Vt., commencing at 8 A.M. on Wednesday, July 9, and continuing six weeks. The situation of Burlington on a hill which slopes down to Lake Champlain, and the frequent fresh breezes, make the climate in summer cool and healthful. It is a place of great natural beauty, and the University of Vermont commands a most beautiful view. Mansfield and Camel's Hump of the Green Mountains, the noble range of the Adirondacks, and the lake with its islands, form a picture which will delight all. The university is a new and handsome building. It contains collections in various departments of knowledge, and a valuable library. The instruction of the college will include, for the adults, French, German, Italian, Spanish, modern Greek, and Romance languages; Latin and ancient Greek; comparative grammar of the English language and the formation of modern English; English literature and rhetoric. There will be each day, for the adults, seven hours of French, seven of German, three of Latin, three of Greek, three of Italian, two of Spanish, one hour each of English literature and rhetoric, comparative grammar of the English language, and the formation of modern English; for the children, two hours of French and two hours of German. The classes will meet every day except Saturday, and the lessons will be given from 9 A.M. to 1 P.M., and from 4 P.M. to 5 P.M. Saturdays will be devoted to recreation. Excursions will be arranged for, at moderate rates, to Ausable Chasm, Mount Mansfield and Camel's Hump, Lake George, Montreal, and other places of interest. Those who purpose attending the College of Languages, or who know but little of this summer school, are recommended to send for a copy of the programme, which may be had at the bookstores of F. W. Christern, New York; Carl Schoenhof, Boston, Mass.; John Wanamaker, Philadelphia, Penn.; Robert Clarke & Co., Cincinnati, O.; and will be sent to applicants by Dr. A. N. van Daell, 28 Atherton Street, Roxbury, Mass.; Dr. William Bernhardt, City High School, Washington, D.C.; Dr. James H. Dillard, Mary Institute, Washington University, St. Louis, Mo.; or Dr. L. Sauveur, Copley Terrace, Roxbury, Mass.

— The stay of some 306 natives from various French colonies, etc., for about six months, in Paris last year, in connection with the exhibition, was an interesting experiment in acclimatization. According to *Nature* of March 6, owing to wise hygienic measures (such as vaccination, good water-supply, isolation of closets, and surveillance of food), these Annamites, Tonquinese, Senegalese, etc., seem to have escaped most of the common endemic diseases. According to the *Semaine Médicale*, they had no typhoid-fever, scarlatina, or measles, though these were in Paris at the time. Some 68 natives were attacked by mumps. The fatigues of a voyage and the change of climate led to a recurrence of intermittent fever, with grave symptoms, in twenty cases. It was thought at first to be typhoid-fever of a severe type; but the rapid and

durable efficacy of sulphate of quinine, given in doses of two to three grams a day, proved the paludine nature of the disorder. It is noteworthy that most illnesses of this population, especially that just noticed, and those from cold, appeared during the first part of the time, when the weather was mild; while in the second period, with unfavorable atmospheric conditions, the illness diminished, whether owing to precautions in the matter of dress and food, or to more complete acclimatization. The negroes of Senegal and the Gaboon seem to have been the greatest sufferers, while the Indo-Chinese race acclimatized the best.

— There are in Berlin 16 *Gymnasias*, — 5 government and 11 municipal *Gymnasias*. The government *Gymnasias* are those of which the expenses are wholly or partly borne by the government. In the 5 government *Gymnasias* there are 82 classes with 3,194 pupils; in the 16 others there are 165 classes with 5,887 pupils. There is one government *Realgymnasium* with 15 classes and 665 pupils, and seven municipal *Realgymnasias* with 102 classes and 3,982 pupils. There are 2 *Ober-realschulen* and 5 higher burgher schools, all municipal. There are 7 high schools for girls, having 114 classes with 5,210 pupils. These 7 schools for girls, compared with the 31 schools for boys, are altogether inadequate. Private schools for girls have therefore sprung up in all parts of the capital, but they are all subject to the inspection of the school committee. There are more than 48 private high schools for girls, with 11,493 pupils. As a bridge between the higher and the lower schools, there are the so-called *Gemeindeschulen* (municipal schools). In these, pupils are specially prepared for the higher schools, and some are directly connected with them. They number 22, and contain 80 classes with 4,105 pupils. Besides these, there are 15 private schools with 116 classes and 3,832 pupils, mostly preparing for the higher schools. A few private elementary schools were kept going through the deficiency in the number of public schools. The municipality placed in them its surplus school population and paid the fees. But the chief *raison d'être* of these schools disappeared with the abolition of school fees and the introduction of free elementary education. Their day is past, and there will no longer be any complaints about the inefficiency of the teaching given in them as compared with that in the public schools. The present cry in Berlin is for more schools and smaller classes. The latter complaint, indeed, is not confined to Berlin, but is becoming general in all parts of the country. The abnormal growth of the capital since 1870 has rendered it very difficult for the municipality to keep pace with the population and provide enough schools. The number of classes in Berlin of overgrown size has risen in the space of one year, 1888-89, from 55 to 106. The cause of this is the thinning of the ranks of the elementary teachers through the low rate of salaries.

— A curious phenomenon is reported from Batoum, says *Nature*. On Jan. 23, at 4 P.M., during a complete calm, the sea is said to have suddenly receded from the shore, leaving it bare to a depth of ten fathoms. The water of the port rushed out to sea, tearing many of the ships from their anchorage, and causing a great amount of damage. After a short time the sea assumed its usual level.

— The Boston Manufacturers Mutual Fire Insurance Company reports the causes of 206 fires occurring during 1889, as follows: foreign matter in stock, 45; picker fires (unknown whether foreign matter or friction), 23; friction of stock, 17; hot journals, 17; spontaneous ignition of oily material, 15; spontaneous ignition of dyes, 12; chafing of belt, 5; gas-jet, 5; kerosene lamp, 4; matches, 3; lightning, 3; steam-pipes, 3; rocket, 1; sulphur bleach, 1; electricity from belt, 1; overheated oven, 1; sparks from broken machinery, 7; sparks from chimney, 3; sparks from cupola, 2; sparks from forge, 2; sparks from burning building, 1; sparks from locomotive, 1; sparks from boiler-setting, 1; sparks from furnace, 1; sparks from core-oven, 1; sparks from card-grinder, 1; back draught, 3; derailed train, 1; various fires in mill tenements, 3; suspected incendiary (two by insane persons), 5; unknown, 18. The times of starting of the fires were as follows: day, 151; night, 39; unknown (all extinguished without claim), 16. The property was classified as follows: cotton-mills, 115; woollen-mills, 39; machine and metal works, 15;

hosiery-mills, 9; storage, 7; paper-mills, 5; bleach and dye works, 3; tenements, 3; jute-factories, 2; rubber-works, 2; silk-mill, 1; linen-mill, 1; cordage-works, 1; miscellaneous, 3. The processes where the fires started were as follows: cotton-picker, 58; wool-picker, 19; mules, 16; cotton-drier, 7; wood-drier, 6; cotton-card, 6; shafting, 6; spinning-frames, 4; fly-frames, 4; boiler-house, 4; looms, 3; engine room, 3; wool-card, 2; blacksmith, 2; office, 2; wheel-pit, 2; sulphur bleach, 1; jute-card, 1; rag sorting, 1; brushing-machine, 1; core-oven, 1; wire drawing, 1; japanning room, 1; wool dye-house, 1; slasher, 1; card-grinder, 1; storage and miscellaneous, 52.

— Those who are interested in the subject of manual and industrial education may like to read a pamphlet on "Manual Training in the Public Schools of Philadelphia," by James MacAlister, superintendent of the city schools. It is issued by the New York College for the Training of Teachers, and gives an account of the courses in manual training and industrial art that have been in operation for some years in certain of the Philadelphia schools. These institutions, however, — the Industrial Art School and the Manual Training School, — are special schools, consisting of picked volunteer students; so that their success or failure is no criterion of the usefulness of manual training in the ordinary public schools. Both the institutions have had good success in their special field, as such schools usually have had where they have been tried. More recently kindergartens have been established in Philadelphia, with manual training as one of the features, but sufficient time has not elapsed to show the effects of their working. Sewing has been introduced into the higher girls' schools, and with favorable results. Mr. MacAlister's pamphlet will be of interest on special points.

— In Bulletin No. 4 of the Rhode Island Experiment Station, the apiarist gives much information about bee-keeping, and reports the work done in this department the first season. Quotations from crop and other reports of the United States Agricultural Department are given to show the importance of this industry in the United States, while facts and figures from the Rhode Island census for 1885 show its condition in that State. Old-fashioned bee-keeping is compared with modern management, its improved hives and better varieties of bees. The value of bees as honey and wax producers is shown; and their greater value as carriers of pollen from flower to flower, thus fertilizing and causing the fruit to set and mature, is considered, and many opinions and facts presented. The desirability of the cross fertilization of flowers and the aid rendered by insects in this work is shown, as well as the adaptability of the honey-bee to the flowers of the most important fruit and vegetable crops dependent upon insect visits. The question as to whether bees injure fruit is presented; the opinion of the government entomologist that they do not, and an account of the careful experiments carried out under his direction to settle the matter, are given. The views of Professors Packard and Gray, as well as of prominent fruit-growers in Rhode Island, are also given. Attention is called to the decision of the Supreme Court of Arkansas as to the unconstitutionality of prohibiting bee-keeping; also to laws lately passed in Germany which give all land-owners the privilege of keeping bees anywhere, promise protection by civil right and law, as well as punish the destruction of bees by poison or any other way by a fine of \$150 or imprisonment for one year. No one need refrain from keeping bees on account of opposition due to ignorance, fear, jealousy, or the ill will of their neighbors, though all reasonable precautions should be taken to prevent accident. An account of the work done at the station during the limited time allowed for it is given. A yard of ten colonies was established, and made as near as possible a model working apiary. The desirable varieties of bees were procured, a daily record taken of a hive on scales, a show of bees in glass hives made at the county fair, and a collection of the different kinds of hives, fixtures, etc., used by prominent American producers, and designed as a permanent exhibit at the station, was commenced. Sixteen colonies were prepared for winter, — three placed in the cellar, and the rest packed in outer cases on their summer stands. Acknowledgments are made of hives and other articles donated; and samples of different kinds of honey from different parts of the

country, as well as all articles of interest to bee-keepers, are solicited, and will be acknowledged in the bulletin. This work is in charge of Samuel Cushman, and the address is Bee Department, Experiment Station, Kingston, R.I.

— The carbons in the new Westinghouse alternating-current arc-lamps are flat, two inches wide, seven-sixteenths of an inch thick, and eight inches and a half long. The upper and lower carbons are the same size, and are consumed at the same rate. One set of carbons is said to last forty-eight hours.

— A project is on foot to dig a ship-canal from a point opposite Grand Island in Lake Superior to the northern extremity of Green Bay in Lake Michigan, cutting across the narrowest part of the long peninsula between those two lakes. The proposed canal is to be thirty-six miles long, and would save two days and a half for steamers and five days for sailing-vessels that would otherwise have to go around the peninsula.

— The report of the Bidston Observatory for the five years 1884–88 is mainly composed of meteorological observations from which it appears that the anemographs furnish very questionable data. The velocity of the wind has been computed on the assumption that the motion of the anemograph's cups is equal to one-third that of the air. The anemograph's pressure-plate presents a surface of two superficial feet to the wind. Both these anemographs are about 210 feet above the sea-level. The investigations conducted by Sir G. Stokes tend to show that the constant for the cups is not 3, but more probably 2.4; and the experiments made by Dines establish the relation between the velocity and the pressure of the wind to be $P = V^2 \times .0035$, though hitherto it has been considered to be $P = V^2 \times .005$. On Jan. 23, 1884, the pressure of wind recorded at Bidston was 70.2 pounds per square foot, and the velocity 78 miles per hour. Other extraordinary pressures with accompanying velocities are as follows: Oct. 26, 1884, 40.6 pounds and 64 miles; March 30, 1886, 41.9 pounds and 62 miles; Dec. 9, 1886, 40.4 pounds and 69 miles; Feb. 3, 1887, 40.1 pounds and 66 miles; May 20, 1887, 65.2 pounds and 78 miles; Nov. 1, 1887, 40.0 pounds and 57 miles; Jan. 26, 1888, 49.2 pounds and 74 miles; May 3, 1888, 44.4 pounds and 66 miles; Nov. 20, 1888, 49.0 pounds and 71 miles. The five maximum pressures, about 40, averaging 40.6, accompany consistently hourly velocities, averaging 64 miles. Now, if the constant for velocity must be reduced from 3 to 2.4, this 64 becomes 51 miles. According to the old formula, the pressure corresponding to 51 miles would be 13, and according to the new formula only 9 pounds, which numbers are in startling contrast to 40.6. Conversely, accepting 40.6 pounds, the velocity by the old formula would be 90, and by the new formula 108, which figures are in startling contrast to 64 miles. Hence, whichever way the data are considered, the results are eminently unsatisfactory. For a pressure of 70 pounds, the corresponding velocity would be 141 miles per hour by the new formula. Only the highest pressures have here been tested, but similar discrepancies prevail all through the series of these anemological statistics. Assuming these maxima pressures to be correct, then the given velocities are greatly in defect; but as the factor 3 has been employed, which is now considered to be one-fifth too great, the given velocities are just as much too large: hence that which is already great should be greater, — an absurdity which leads to the inference that the instruments are unreliable. The mean velocity per hour is really given, whereas the absolute velocity, expressed as rate per hour, of the most violent gusts, lasting perhaps only a few seconds, is wanted. *Engineering* points out that it seems too much of a stretch of confidence to accept the pressures as reliable, inasmuch as none so high have been obtained anywhere else. The inference, therefore, must be that the accuracy of the anemographs at Bidston is extremely doubtful, and it becomes important to make these apparatus the subject of critical investigation. Until this has been efficiently done, no reliance whatever can be put upon their results, which is very much to be regretted, as the data extend over a long series of years, and if reliable, or could be made so, would be of the utmost scientific value.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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THE SAILOR AS AMATEUR ENGINEER is not always a success. A naval court of inquiry has recently been in session which has revealed some interesting phases of the amateurishness of the "Yankee tar," and of his inclination at times to play the jack at all trades without much regard to consequences affecting either his own reputation or the efficiency of his vessel. It seems that the commander of a naval vessel, assuming himself to be possessed of the requisite professional knowledge, took charge of the engineering of his ship, and "gave the engineer permission" to make repairs only when he (the skipper) saw fit. The chief engineer had been "ordered not to use salt water in the boilers," had been "told that fresh water would be used in boiler No. 3." The captain had told him that "salt water would not be used except at sea;" but the engineer, apparently thinking himself as well informed of the principles and the customs of the case as was the captain, actually did on one occasion fill a boiler with salt water when in port, after some repairs had been made upon it, for the purpose of testing it to ascertain if it was tight. He endeavored to explain to the superior officer, when called upon to defend this practice, that it was for this purpose; but the commander promptly informed him that he cared nothing for his opinion, and so "sat down upon" and "walked over" the junior officer (figuratively speaking, if we understand aright) that the latter

was moved to inquire, mildly of course, whether it was the fact that he was to be "treated like a pickpocket." This is an interesting illustration of the ethics, the amateur engineering, and the manners, accepted, as it would seem, on board at least one of the ships of our great "navy."

We need not here concern ourselves with the ethics of the case. The court of inquiry will probably establish the code for the naval service, and we may presume that the dignity of the amateur-engineer commander will be properly vindicated. No subordinate officer will probably be allowed with impunity to protest against being "treated like a pickpocket" by his senior, whatever be the altitude of the latter on a scale which measures in terms of good sense, good manners, and good feeling, such as becomes a "gentleman and an officer." We may be permitted to doubt, however, that the senior officer will be called seriously to account for any lack of officerlike quality which may manifest itself in his treatment of his juniors—unless the secretary of the navy, Gen. Tracy, who is himself familiar with the accepted ethics of civil life, as well as with the exactions of military "discipline," shall determine to act in the matter. The line which separates the gentleman from the officer is sometimes made so broad, in cases involving discipline and admonition of the junior by his senior, that the latter fails to detect the fact that the two should be, and should always remain, fairly coincident. We may perhaps be permitted to mildly suggest, however, that the importation into the navy of gentlemen, and the deportation of men of other stripe, might apparently be carried on to considerable extent, and with great advantage. The suggestion is with diffidence respectfully submitted to the honorable secretary of the navy.

On the other aspects of the case, as involving a question of chemistry applied to engineering, we may, we think, be permitted to hold an opinion without asking leave of the very respectable, but we think too decidedly amateurish, sailor on horseback who mounts his hobby to such manifest discomfiture of those over whom he is by his commission enabled to ride. If it should prove that the engineer in charge was so grossly ignorant as to imagine that he might safely and continuously employ salt water in his boilers on a long cruise, even though he had surface condensers, and was not aware that the result would be the precipitation of sulphate of lime in large quantity, to the utter demoralization of his coal-pile and the injury of his furnaces, we should say that this officer was right in treating him, not like a pickpocket, to be sure, but with distinct severity. Even an amateur engineer should know better than that; a commanding officer, if fit for his place, should certainly know at least so much. If it should prove that the engineer desired simply to test his boilers for the purpose of detecting a leak, knowing that it requires a temperature approximating 300° F. to cause precipitation of calcium sulphate, we should consider him to be right in using it, and the commander very ignorant, even for an amateur engineer, not to know better than to interfere. There is a popular feeling—which it will probably be very difficult for the aspirant amateur to remove, notwithstanding his acknowledged and unquestionable ability to become a jack at these several trades which go to make a cruise successful—that the commander is placed on board ship to direct its general operations; and that he is given a corps of engineers to attend to details, with which they only are trusted, and with which, as experts, they only can deal; while the amateur-engineer captain, like the amateur-naval architect, even though the latter be the ablest of lawyers, had best keep himself within those lines which bound his own specialty, and play the amateur only in unimportant matters, in which no great interests are involved.

BOOK-REVIEWS.

A Handbook of Engine and Boiler Trials, and of the Indicator and Prony Brake. By R. H. THURSTON. New York, Wiley. 8°. \$5.

THIS work, being virtually the first of its kind, must of necessity fill an important place in the literature of the steam-engine; and the fact that Professor Thurston is the author is sufficient guaranty that it may safely be accepted as a standard of reference while present methods of steam-engine and boiler tests are in vogue. Engineers making tests of this kind have hitherto been compelled to do so without any definite standard of reference; and no generally accepted criterion has been available for the engineer who wished to record the results of engine or boiler trials in an acceptable and permanent manner. The long-existing want of such a criterion has led to a general concurrence among engineers that a system, provisional though it may be, is feasible, according to which both engines and steam-generators may be satisfactorily tested. This system, which is based upon the work of a committee of the American Society of Mechanical Engineers, of their brother engineers in Germany, and of other recognized experts and authorities, is admirably presented in Professor Thurston's work.

This treatise presents, in a concise though clear and easily understood form, those methods of trial of heat-engines which have become standard; exhibits the processes of their application; describes the best forms of apparatus in current use in conducting the trials and in securing the data sought; and illustrates the uses and capabilities of these apparatus. It also presents examples of the reports made by distinguished engineers on important work of this character, and thus gives good examples of the form of such reports, and of the data and results deduced from them in the case of the better classes of machinery and apparatus.

The system of boiler trial described in this work is that proposed by the committee of the American Society of Mechanical Engineers, since become standard in this country, and to a great extent abroad. It is complete and satisfactory, having been found sufficient, so far, to meet every ordinary requirement.

A chapter is devoted to the steam-engine indicator, giving a brief and simple account of that instrument and its capabilities, as well as a description of the usual and best ways of handling it, though no attempt has been made to elaborate to any great extent the study of the diagram. Many forms of diagram, however, are illustrated, and the student is referred to special treatises on the indicator for further information on the subject. A description of the methods usually considered best and most exact in the measurement and computation of the indicator diagram is given in a separate chapter, as well as of the processes leading to the more important of the results attainable by the use of the instrument.

A series of valuable reports, written by able engineers as models of data summaries and of conclusions derived from such summaries, add to the completeness of the work. One example in each of the more important classes of steam-engine is studied in this manner, and any engineer, by a study of the series, should be enabled to secure satisfactory results in making tests, even though previously inexperienced in such work. An appendix contains all needful constants and reference-tables, and an abundance of illustrations adds much to the clearness and value of the text.

The Origin of the Aryans. By ISAAC TAYLOR. (Contemporary Science Series). New York, Scribner. 12°. \$1.25.

THIS is an able and interesting book, the object of which is to give the latest results of the controversy concerning the origin of the Aryan races. It opens with a chapter on the history of the subject, beginning with the assumption of the philologists that the original home of the undivided Aryans was in Central Asia, whence the various branches of the common family migrated to their present seats. This assumption is easily shown to be baseless, and the old theory has now been abandoned by the majority of archæologists. Moreover, it is

now generally held that the greater portion of the population in the countries we now call Aryan really belongs to other families of mankind, and that the widespread prevalence of the Aryan languages is due to conquest by Aryan peoples. The evidence of this is mainly anthropological, and its presentation occupies a considerable portion of Mr. Taylor's book. He repeats the various arguments that have been adduced to prove that the original home of the Aryans was in Europe, which he regards as conclusive. But the question then arises as to which of the prehistoric races of Europe is to be regarded as the original Aryan stock. On so difficult and so unsettled a question we shall not here offer any opinion, but will briefly indicate the evidence and the arguments that have thus far been adduced.

The skulls and other remains of the neolithic age point pretty clearly to the fact that at that time the greater part of Europe was peopled by four distinct races,—the Iberians in Spain, Britain, and some other places; the Ligurians in central France; the Celto-Slavic race in central Europe; and the Teutons, or Scandinavians, in the north. Of these, the Iberians seem to be related to the Hamites, and the Ligurians to the Turanian family; so that, if the original home of the Aryans was in Europe, the original Aryan race must be either the Teutonic or the Celto-Slavic. Here, therefore, is now the main point of contention, the German writers generally upholding the claims of the Teutons, and the French those of the Celts. The dispute has been conducted with considerable acrimony and with a rather unseemly exhibition of national feeling on both sides, and is still unsettled. Mr. Taylor inclines in favor of the Celts, but maintains a judicial attitude, and avoids a decisive expression of opinion. He presents the evidence on the whole subject, however, at considerable length, and the clearness of his style makes it intelligible to the reader. Those who wish to know the latest views and arguments on the question will find his book useful.

Laboratory Manual of Experimental Physics. By ALBERT L. AREY. Syracuse, Bardeen. 24°. 75 cents.

THE author of this book is a civil engineer by profession, and at present is instructor in physics at the Rochester Free Academy. The aim of the book is to describe such experiments as will lead to quantitative work on the part of the student, and the author lays considerable stress on the importance of bringing home to the students the existence of a personal error in observations, that within limits can be much reduced by using intelligence and care. All simply illustrative experiments are omitted from the book, the author believing, with most teachers in this field, that such can be carried out to the best purpose on the lecture-table.

It is needless to say that the experiments described can be performed with apparatus of the simplest kind, most of it capable of being home-made. Many of them are new, and are sure to be suggestive to those engaged in teaching of this character.

Whether we approve of the alternate blank pages intended for notes supplementing the text, we can hardly say; yet that these notes will be well entered by some is very true, and for such the benefit of forming a habit of noting down points brought out at the time of experimenting will be considerable.

Fort Ancient. By WARREN K. MOOREHEAD. Cincinnati, Robert Clarke & Co. \$2.

MR. MOOREHEAD and a competent staff of assistants spent the season of 1889 in making a careful survey of Fort Ancient, the renowned earthwork of Ohio. The results of his investigations have been published in the present volume, which is most beautifully illustrated with excellent photo-engravings, which greatly enhance its value. From his extended researches the author draws the following inferences: Fort Ancient is a defensive earthwork, used at times as a refuge by some large tribe of Indians, and at times there was a large village situated within its walls. The fields within the wall, especially in the enclosure of the old fort, are covered with pottery fragments, bones, arrow-heads, and flint chips. The ground has many

burnt stones below the surface. There are traces of villages in the country surrounding the fort. The author expresses his conviction that the fort possesses nothing of a religious nature.

A pavement which has been found inside may have been used as a place for the war-dances or councils of the tribes assembled in the fort. The author believes that these tribes were in advance of the Shawnees, the Delawares, and others who occupied the territory in 1787. But they did not know the art of smelting, though they used hammered copper and galena. In concluding, the author calls attention to the similarity of the arts of the Mandans and the tribes who inhabited Fort Ancient, and expresses the opinion that they may have been the builders of the works. The book proves to be the result of a very careful and detailed investigation, for which ethnologists will be thankful to the author, even should his theories not find general acceptance. The endeavor, which appears throughout the book, to represent the finds and the methods in which they have been obtained as clearly as possible, which is supported by the excellent illustrations accompanying the descriptions, gives the work value aside from all theoretical considerations.

Railroad Engineers' Field-Book and Explorers' Guide. By H. C. GODWIN. New York, Wiley. 16°.

To the many railroad engineers who do not consider themselves expert mathematicians this field-book will prove of exceptional value. It contains, in small compass, every thing that can reasonably be sought for in a book of the kind, intended solely for use in the field; leaving those things which pertain to extreme accuracy, and which may be rarely needed, for a supplementary or complementary volume, which may be assigned a place with the camp equipage. The idea which prompted the preparation of the volume is good, and we think it has been well worked out. The author has avoided as much as possible the intricacies of mathematics, and at the same time has produced a work of more general application than might have been expected by engineers familiar with books of its kind.

The book is divided into four principal parts, the first dealing with railroad location, the second with railroad construction, the third with reconnaissance and exploratory surveys. The fourth is devoted to general information of a miscellaneous but no less useful nature. To these are added an appendix and a set of tables. The book is well adapted to the use of railroad engineers engaged on location and construction work, as well as to the use of the explorer in making exploratory surveys.

AMONG THE PUBLISHERS.

READERS of all classes, young and old, will be glad to know that the Scribners are issuing a new book by Mrs. Frances Hodgson Burnett. It will be entitled "Little Saint Elizabeth, and Other Stories," and is an attractive picture of child-nature.

— The second volume of Donald G. Mitchell's latest work, "English Lands, Letters, etc.," will soon be published by the Scribners. It will contain the author's talks about historical and literary England from the time of Elizabeth to Queen Anne, Shakspeare being the first, and Swift the last, personage of importance who passes under review.

— A timely article is "Stanley's Emin Pasha Expedition" in *Lippincott's* for April. A concise biographical account of Emin Pasha is given, and also the reason of Stanley's expedition, with other information.

— Mr. Marston, of the London publishing-house of Sampson Low, Marston, & Co., wrote recently from Cairo, where he was in company with Mr. Henry M. Stanley, "Mr. Stanley is devoting absolutely the whole of his time, from early in the morning (sometimes as early as 6 o'clock) till late at night, in writing his great book. I have read a good part of the text, and I think I may say, without being accused of puffing, that it is profoundly interesting. I am happy to add that Mr. Stanley was well pleased to learn from me that I had completed satisfactory arrangements for si-

multaneous publication in France by Messrs. Hachette & Co., in America by Messrs. Scribner's Sons, in Germany by Mr. Brockhaus, in Spain by Espara & Co., in Italy by Messrs. Treves, and in Scandinavia by Mr. Mallings."

— There is an article on "Egypt at Home," by Rev. Dr. W. C. Winslow, vice-president of the Egypt Exploration Fund, in the April number of the *New England Magazine*. It is an account of the Egyptian collection in the Boston Museum of Fine Arts, the most important Egyptian collection in America, and is illustrated. The number will also contain a full page portrait of Miss Edwards, from a recent photograph by Sarony, with an article upon her work by Mrs. Sallie Joy White, and several facsimiles of passages from her letters and manuscripts.

— To Shakspeare students the plan and scope of Dr. Furness's "Variorum Shakspeare" are known, as are the pains, judgment, and critical faculty expended upon them. Each play as it appears brings into one focus all the wealth of a great Shakspearian library, so arranged as to be immediately accessible. "As You Like It," the eighth volume of this splendid edition, will be published by J. B. Lippincott Company on April 25. The volumes previously issued are "Romeo and Juliet," "Hamlet" (two volumes), "Macbeth," "King Lear," "Othello," and "The Merchant of Venice."

— The publishers of the *Electrical World* have secured the services of Dr. Louis Bell, who will in future have editorial control of that enterprising journal. T. C. Martin and Joseph Wetzler, who have heretofore edited the *Electrical World*, have taken editorial charge of the *Electrical Engineer*, and that well-known paper will henceforth appear as a weekly.

— Civil-service reform has a champion in Mr. Oliver T. Morton, who, in a paper called "Some Popular Objections to Civil-Service Reform," which appears in the *Atlantic* for April, is not afraid to say that the spoils system "is at war with equality, freedom, justice, and a wise economy, and is already a doomed thing fighting extinction. Its establishment was in no sense a popular revolution, but was the work of a self-willed man of stubborn and tyrannical nature, who had enemies to punish and debts to pay." This certainly strikes no uncertain note. The article is divided into sections, each one of which is headed by a paragraph which embodies some objection to the movement.

— The April issue of the *Quarterly Journal of Economics*, published for Harvard University, will contain articles by President Francis A. Walker on "Protection and Protectionism," in which arguments for and against protection are temperately discussed; by Professor Taussig of Harvard, on the "Silver Situation, its History and its Dangers;" E. C. Gonner of Liverpool, Eng., on "Ricardo and his Critics;" F. B. Hawley of New York, on "Profits and the Residual Theory;" N. Matthews, jun., of Boston, on the "Taxation of Mortgages in Massachusetts." There will also be notes and memoranda on the law against socialists in Germany, on recent works on finance and political economy, and the usual bibliography.

— Of the contents of *Outing* for April, we note "Signaling for Antelope on the Staked Plains," by William H. Johnston, jun.; "Wheel and Camera in Normandy," by J. W. Fosdick; "Melton Mowbray; or, Fox Hunting in the Shires," by "Merlin;" "Some Defects in Tennis," by D. C. Robertson; "Tennis Scores," by William Strunk, jun.; "Bowling for Women," by Margaret Bissland; and "Yacht Racing in Great Britain," by F. C. Sumichrast.

— The wide-felt interest in the present discussion of the revision of the Westminster Confession of Faith has manifested itself in a steadily increasing demand for the recent publications relating to the subject. The Scribners have brought out a third edition of Dr. Briggs's "Whither?" and the pamphlets entitled "Biblical History," and "Whither? O, Whither?" by Dr. McCosh; also a new edition of Dr. Schaff's "Creed Revision," with an appendix containing a report of the discussion in the Presbytery of New York. The same publishers are issuing a new contribution to the subject by Dr. Shedd, entitled "The Proposed Revision of the Westminster Standards."

— The Scribners will publish immediately a small book by George W. Cable, entitled "The Negro Question," containing the address delivered by the author on Washington's Birthday before the Massachusetts Club in reply to the memorable speech by the late Henry W. Grady; also several open letters by Mr. Cable on this subject.

— The Scribners will issue shortly the first of a series of interesting memoirs of "Three Famous French Women," translated from the French of M. Imbert de Saint-Amand, by T. S. Perry. The subject of the first volume will be the Empress Josephine, and will be entitled "The Wife of the First Consul." Other works will follow on Marie Antoinette and the Empress Marie Louise.

LETTERS TO THE EDITOR.

Means of increasing the Accuracy of locating Vessels at Sea.

IN looking over some meagre accounts of the recent meeting of the International Maritime Congress, I failed to find any mention of a very important branch of navigation to which my attention was attracted some years ago. I refer to the question of the present accuracy of the instruments for determining the position of a ship at sea, and the steps that must be taken in order to improve this accuracy. The reasons that make this an important matter are so obvious that it is not necessary to catalogue them. I need only say that in approaching any coasts, dangerous reefs, shallow waters, and, in the case of sailing-vessels, the paths regularly frequented by steamers, it is of the greatest importance to be able to locate the ship's position with all the accuracy attainable.

In 1881 Professor W. A. Rogers, the eminent American astronomer and physicist, read a paper before the Naval Institute at Annapolis, published in the "Proceedings" of the institute, bearing the title "The Co-efficient of Safety in Navigation."

This paper is spoken of by Commander P. F. Harrington, U.S.N., as being "remarkable for the extent and thoroughness of its investigations, and valuable in the application of its results to the practice of navigation. . . . Its practical conclusion and warning ought to be impressed upon every man who is permitted to lay a vessel course."

In this paper Professor Rogers shows the various errors which enter into the determination of a ship's location at sea; and he determines, finally, an average error and a possible error of position from a large number of observations, as shown by logs of vessels in various quarters of the globe. Upon his inquiring of a number of sea-captains as to the limits within which a ship's place can be ordinarily determined, most of them said a mile was the limit, some few said half a mile, and only one man gave so high an estimate as five miles.

The chief sources of error seem to be those pertaining to the compass, chronometer, and sextant. For the compass, Professor Rogers does not come to any very definite conclusion; at least, no numerical estimates of error are made.

A discussion of the rates of a large number of chronometers shows, that, for a chronometer of average excellence, at the end of twenty days an average error of 3.6 miles must be expected, and an error of 11.5 miles must be looked out for. The error of the chronometer increases with the time occupied in the voyage; and a discussion of the errors of one hundred chronometers by Mr. Hartnup of Liverpool (and probably no more capable man has ever examined into the matter) showed that at the end of a voyage of twelve months the error in one of the ship's positions was 524 miles. Another extreme instance cited is the case of Lord Anson's voyage around Cape Horn, in which one ship "actually made land on the wrong side of the continent, the error of position being over 600 miles."

For the sextant observations it is difficult to determine the limit of accuracy; but "the average error of a single observation at sea is not far from 3 miles, and the average co-efficient

Publications received at Editor's Office,
March 17-22.

- EARL, A. G. The Elements of Laboratory Work. London and New York, Longmans, Green, & Co. 179 p. 12°. \$1.40.
- ELECTRICS, Practical: A Universal Handy-Book on Everyday Electrical Matters. London and New York, Spon. 135 p. 18°. 75 cents.
- GEDDES, P. and THOMSON, J. A. The Evolution of Sex. New York, Scribner & Welford. 322 p. 12°. \$1.25.
- HURST, J. T. Spon's Tables and Memoranda for Engineers. 10th ed. New York, Spon. 140 p. 48°. 40 cents.
- MAYCOCK, W. P. Practical Electrical Notes and Definitions, for the Use of Engineering Students and Practical Men. London and New York, Spon. 130 p. 24°. 60 cents.
- NEW YORK State Board of Health, Eighth Annual Report of the. Transmitted to the Legislature Feb. 27, 1888. Albany, Troy Press Co., pr. 348 p. 8°.
- Same. Ninth Annual Report Transmitted to the Legislature Feb. 26, 1889. Albany, Troy Press Co., pr. 609 p. 8°.
- SPRAGUE Electric Railway & Motor Co., Applications of Electro-Motive Power by the New York, Sprague Co. 47 p. 8°.
- Stationary Motors, Facts about the. New York, Sprague Co. 31 p. 8°.
- STREET Railway Companies, To Managers of. New York, Sprague Electric Railway and Motor Co. 26 p. 8°.
- TAYLOR, I. The Origin of the Aryans. New York, Scribner & Welford. 339 p. 12°. \$1.25.
- TUNZELMANN, G. W. de. Electricity in Modern Life. New York, Scribner & Welford. 272 p. 12°. \$1.25.

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Associate of the Linnean Society, author of "Historia Filicum," "History of Bible Plants," etc., etc.

For more than forty years Mr. Smith was connected with the Royal Gardens, Ken., which gave him remarkable opportunities for becoming acquainted with the largest collection of living plants, native and exotic, ever brought together; and from 1846, he was associated with the late Sir W. Hooper in building up the Kensington Museum of Economic Botany. Based on all this experience, Mr. Smith has produced this Dictionary which gives under their popular names information about plants that furnish the wants of man, their history, products and uses. Having received a large invoice of this book from the London publisher, we offer to mail copies postpaid at a discount.

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by which this number must be multiplied in order to provide for every contingency of danger is 3.5."

Having called attention to the accuracy, or rather the inaccuracy, with which a ship's position is found at sea, I wish to make a few suggestions which have occurred to me in the course of my professional work, and which ought, perhaps, to be considered by marine authorities.

In each of our large seacoast cities the Maritime Exchange is the principal place where ship-masters, ship-owners, shippers, marine underwriters, and other men interested in ocean commerce, meet for the purpose of arranging matters connected with the transportation by sea, and it is through these exchanges that the plan I have to propose could be most readily carried out.

What I have to propose is this: that there should be an enforced frequent inspection of the instruments used by ships' officers in determining the positions of vessels at sea.¹ Whether it would be necessary to have a law enacted by legislation, or whether the marine insurance companies would demand such an inspection before issuing policies, or whether the Maritime Exchanges would take up such a work on their account, I cannot more than surmise. I think likely that the former would be necessary; but, as the details of the work would be about the same in any case, I have assumed that the members of the exchanges would be willing to carry on the work without any "pressure" from outside.

Let, then, the maritime exchanges of each port adopt a rule that the sextants, compasses, and chronometers of all vessels with which the exchange has dealings shall be inspected every three months, or every six months, or at the close of each voyage, or whatever length of time may be considered sufficient. Let each exchange request the secretary of the navy to assign to duty at its port a sufficient number of officers and men to carry out this inspection. That this last is possible, is shown by the fact that for some years officers of the navy have been assigned to duty at several of these exchanges for the purpose of collecting observations made on shipboard (the United States Signal Service was also represented there in connection with meteorological matters). Probably one lieutenant and two subordinate officers would be sufficient to do all the work necessary for the port of New York. As to the details of such a work as is proposed, there is only space to mention enough to show the necessity of it, and to show its practicability.

Upon the master of a ship reporting his arrival at the exchange, let the naval officer at once take steps to inform himself of the condition of the sextant, chronometer, and compasses carried by the vessel.

The sextant is very easily thrown out of adjustment; and, the errors being determined with great difficulty without proper apparatus, they are usually left for the maker to re-adjust. The result is, that in many cases a sextant is used until it is found to be utterly worthless, and then only is it taken to be repaired.

Let each ship-master be required to show a certificate of examination of his sextant; this to hold good for a stated time, and to be furnished free of charge by the exchange. It would not be such a laborious task as it may seem, to examine the sextants; for, if a Neumayer sextant stand (a description is given in the "Archiv" of the Deutsche Seewarte, Jahrgang I. 1878, p. 16) be mounted in a convenient place, it would take the operator but a few minutes to detect the errors in adjustment of a sextant placed thereon, and he could even undertake any minor re-adjustment; but for any serious fault in the instrument it would have to be corrected by an instrument-maker.

The sextants belong to what are known as constant instruments, and may keep unchanged for a long time; but chronometers are variable instruments, and have to be compared with a standard as frequently as possible. This difference in the instruments is so easily and generally recognized, that, while

the sextants are so seldom inspected, the chronometers, on the other hand, have been taken to chronometer-shops at the end of each voyage, no matter how short, to have the rate of change determined, and to have the error noted just before the departure on the next voyage. I say "have been," because, much to my astonishment, the leading chronometer-maker of Boston informed me some years ago, and shortly after the Boston time-ball had been established, that this time-ball had about ruined the chronometer-rating business, and that most of the ship-masters (especially those of foreign vessels) rated the chronometer on shipboard by observing the fall of the time-ball at noon of each day. As these time-balls have now been established in the principal ports all over the world, it is safe to conclude that this change in the methods of rating chronometers is universal. I consider that this is a step backward in the progress of maritime science, and that there is much less security against navigators getting out of their "reckoning" than existed before this change of method took place. I will state briefly my reasons for thinking this.

1. A chronometer needs frequent inspection by an expert chronometer-repairer in order to see that all parts of the instrument are in good order. By the old method this could be done every voyage when the chronometer was being rated; but now it is probable, that, in cases where a time-ball can be observed, these instruments will not be submitted to the repairer until after experience has shown it to be in a decidedly bad condition.

2. A chronometer cannot possibly be rated as accurately by observations of a time-ball as by the means employed in the regular chronometer-shops. In the former case, observations cannot be made on days with rain or fog; it is quite probable that the same person will not be able to make the comparison for the whole succession of days, and a personal difference of half a second or more may occur between two observers; the error in observing the drop of a time-ball is probably not less than half a second, and many observers would not get the time closer than a second; the time-ball is usually dropped only once daily, so that any error in observing it cannot be detected; the observer on shipboard can have no idea of the errors and the daily changes in the standard clock by means of which the ball is dropped, and must rely implicitly on the accuracy of this signal during spells of cloudy weather, when, as well known, the standard clocks of the best astronomical observatories may be some seconds in error; and if the ship is in port only a brief time, and the chronometer rating should occur during a week when no observations can be made at the observatory, the probability is that a very erroneous rate would be assigned to the chronometer, for use during the coming voyage.

3. In the chronometer-shops the electric time-signals are received from the observatory or standard clock at regular intervals, usually every second or two seconds or minute. The signals are received daily, and comparisons can be made without regard to the weather, so far as distinguishing the signal is concerned. The chronometer comparisons are made by means of a "hack" chronometer, which has been accurately compared with the time-signal, and are made by some one person. A skilled man can compare two chronometers without having an error of more than one-tenth of a second, and the comparison can be made several times a day if it is desirable; and this is an important matter if the ship is to be in port only a few days. During cloudy weather, when it is impossible to make astronomical observations, and it sometimes happens that a whole week will pass without an observation being made, it is possible for the chronometer-maker, who usually has on hand a large number of first-class time-keepers, to keep his own standard clock nearer to the true time than that given by the observatory clock, because he relies on the average results given by a large number of time-pieces, while an observatory seldom has more than two. In this case the chronometer-shop rating of a ship's chronometer is much more accurate than that by means of a time-ball. Accidental errors in the standard clock-signals due to occasional mistakes made by the astronomer can be detected (if they are large) by the

¹ This proposal is by no means a new one, but some points which I shall mention in connection with it I have not seen mentioned before.

chronometer-maker, but the navigator rating his own chronometer is easily misled by them.

4. There is still a point to which I wish to make a brief reference; viz., the absolute accuracy of time-signals in general; for this question is one of great importance in rating chronometers. The best data that have yet been obtained for determining this question are the series of daily comparisons of time-signals of the Naval Observatory at Washington, the Cambridge (Mass.) Observatory, and the Allegheny (Penn.) Observatory; this having been done for some years by Mr. James Hamblett of the Gold and Stock Exchange of New York City, in order to regulate the standard clock which furnishes New York with accurate time. The comparisons frequently show differences of two and three seconds between the observatory standard clocks, and I believe instances are not wanting in which the amounts reached even five seconds.

Recognizing that these comparisons could not, perhaps, lay claim to the greatest accuracy attainable, an elaborate plan was matured some years ago by which the United States Signal Service should make a daily comparison of the time-signals of a dozen of our principal observatories, and thus find out with certainty the accuracy attainable by a single observatory, and to inquire into the desirability of the permanent organization of a sort of clearing-house system of time distribution, by means of which a very accurate time-signal could be distributed over the whole country, no matter what the weather might be. For various reasons this plan was not carried out, but its execution is still very much to be desired.

Taking into account the just mentioned facts, and others which might be given, I think that a careful inspection of the ships' chronometers and their rates should be made as frequently as may be found possible. The exact form of this inspection, which might be undertaken by the exchanges, and the best method of securing the greatest accuracy in rating ships' chronometers, cannot be discussed here.

Concerning the compasses on shipboard, I will only say, as has been frequently urged, that they should be examined and tested at every opportunity. The possible errors of the compass have been thoroughly studied, and those existing can be accurately determined; but the subject is too technical to be explained in a few words.

FRANK WALDO.

Cincinnati, O., March, 1890.

Storage-Batteries.

MANY a person who has experimented with secondary batteries has become convinced, as I have, that the Planté form of battery was superior, especially as regards durability, to any of the various batteries in which the "active material" is applied in the form of paste. Realizing that this superiority was mainly due to the relation of the molecules of the active material with each other, and also their relation with those of the support part of the electrode, I was led to make experiments, the outcome of which was a storage-battery, which I have patented. For the sake of illustrating how the Planté form of battery is superior to the pasted forms, I will suppose that a piece of wood represents the support of the pasted plates, and that sawdust represents the oxide which is to be applied to the support part of the electrode in the form of a paste. The sawdust may be mixed with this, that, or the other liquid, and made to adhere to the wood, to a greater or more likely to a lesser extent. I immerse this wood electrode, if I may be allowed to call it such, in sulphuric acid: the sawdust will fall off in a comparatively short time, leaving the wood support to a more gradual destruction. If the surface of wood could be changed in some way so that it would resemble sawdust, and yet in such a way that the molecules of this changed surface preserve to a considerable extent their original relation with each other (that is to say, their original attraction for each other), and at the same time preserve their attraction for the molecules of the unaltered portion, we would then have a wood electrode (I apologize for the term) which would resemble the lead electrode of Planté. Almost invariably, when the pasted electrodes peel, they do so, not from the surface of the

"active layer," but from the surface of the support metal. I have experimented with but one Planté battery, which, by the way, was the first storage-battery that I ever made. This battery was charged to its greatest possible capacity many times, and also discharged suddenly, but the active layer has not peeled from the non-oxidized portion of the lead plate. There has been at times a falling of fine particles of peroxide, but no peeling such as you get in pasted batteries.

The sooner storage electricians recognize that the greater the attraction of the molecules of a secondary electrode for each other, the more durable will the electrode be, the better for all concerned. Just as soon as storage electricians recognize the fact that the quality of a storage-battery is to be judged, not by the amount of peroxide the electrodes contain, but by the degree of attraction which exists between the molecules of the active layer, their experiments will be more fruitful, and the pasted plates of to-day will be no more. The problem is not how to store oxygen, but how to increase the affinity of each molecule of an oxide for its neighbor. Hoping that these remarks will set the readers of *Science* a-thinking, and that they may have some weight towards convincing them that all that is necessary in a good storage-cell is molecular affinity, I close my communication with great faith in the future of storage electricity.

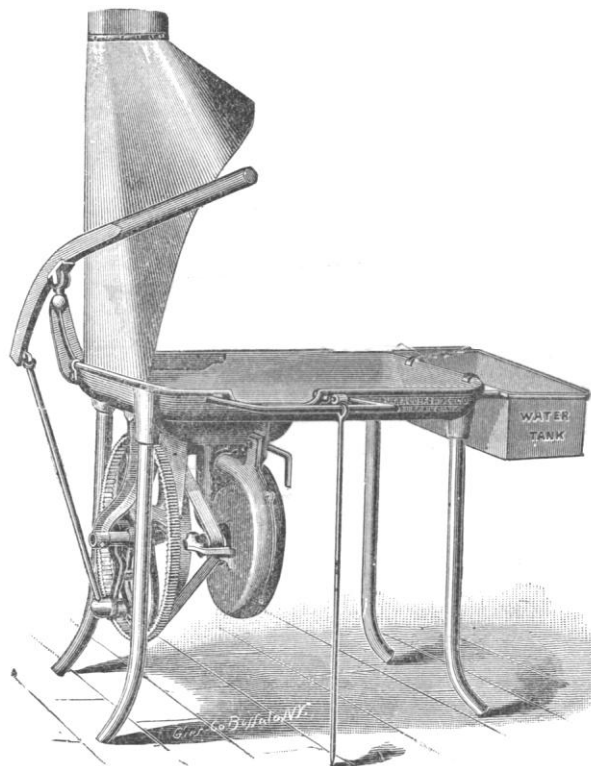
N. B. ALDRICH.

Fall River, Mass., March 18.

INDUSTRIAL NOTES.

Buffalo Blacksmith's Forge.

Few progressive blacksmiths or metal-workers who look into the matter fail to acknowledge the superiority of the modern portable forge over the bellows and stationary blast-furnace. By



A NEW BLACKSMITH'S PORTABLE FORGE.

the use of an improved portable forge, heat is produced more quickly and with less labor and cost. The portable forge also takes less space, while, so far as durability and reliability are concerned, a comparison between the two is much to the disadvantage of the old style. The first cost of the brick forge is greater, and subsequent repairs and occasional movings make a considerable item of expense, while repairs are seldom required on an improved portable forge; and it may be moved from one part of the shop to another with little trouble.

In the accompanying engraving is shown the latest pattern of improved portable blacksmith forge, made by the Buffalo Forge Company. The distinguishing features of this forge are, easy lever and swivel movements; steady powerful blast for heavy work, and even, light blast for light work; no dead centre to overcome in starting; all of which are important factors in the successful working of a forge. The bearings, which are of hardened steel and of more than ordinary length, deserve comment also. By referring to the illustration, which shows the No. 0 size, it will be seen that the forge has a large fan-case, 14 inches in diameter, which affords a maximum blast with a minimum expenditure of power. A point of importance is that the blast continues some little time after a stroke is made, sufficient to allow the operator to work upon the iron quite a while before it ceases.

This forge is also arranged for belt attachment, for general use in large shops where power is used. When run by belt, a cut-off for the blast is provided, which permits of the fire being regulated to any required degree.

The A. B. C. Electric Motor.

ONE of the latest additions to the long list of small electric motors now in the market is shown in Fig. 1. It is made by the A. B. C. Motor Company of this city, and embodies some of the ideas of Mr. Brown of that company.

The A. B. C. motor is designed so as to obtain, with a small expenditure of current, a maximum amount of magnetism, and to produce a machine that will do its work at a high rate of efficiency over a wide range of power, and at a moderate and constant speed under all loads. The field-magnets are laminated, permitting the use of sheet iron, a form in which soft, pure iron can be obtained of uniform quality. The several laminated sections, as shown in Fig. 2, are bound together, not by means of bolts passing through them in the usual manner, but by an arrangement of rods fitting into the notches shown, which are formed by the die in the outer edges of the plates. By means of this construction any irregularity caused by inexactness in the separate punching of holes is rendered impossible. The field-magnet has but one coil, and consequently no yoke is necessary in its construction. The field-magnet is ample in cross-section, and as short as possible, the entire space between the limbs being filled by the coil and the armature. This form of construction gives a magnetic circuit of very low resistance.

The armature is thoroughly insulated, and can be removed very quickly if necessary. The brushes, being at the top, can

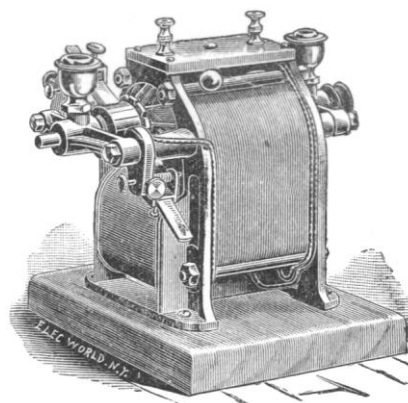


FIG. 1.

also be readily inspected; and, the armature being elevated, it is not necessary to place the motor on a special base when required for fan purposes. The mechanical construction of the

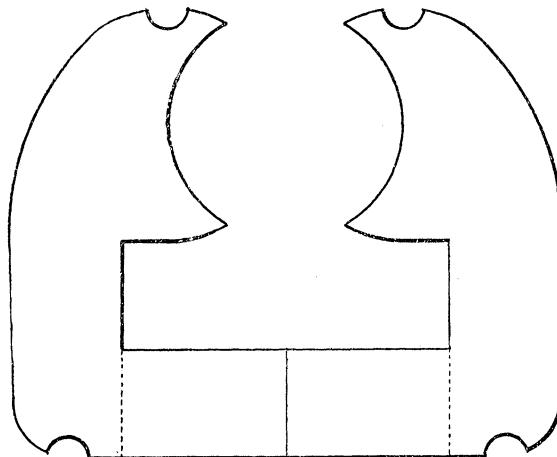


FIG. 2.

motor throughout has been carefully attended to, and all the details of the motor have been well worked out.

If you have a
COLD or COUGH,
acute or leading to
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